

Application Number 09/992,980
Amendment dated November 21, 2003
Reply to Office Action dated September 11, 2003

REMARKS

Claims 1-8 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite. The term "non-inert nitrogen" has been deleted from the claims. Accordingly, it is believed that the rejections under 35 U.S.C. §112, second paragraph, are overcome, and reconsideration of the rejections is requested.

Claims 1-8 are rejected under 35 U.S.C. §103(a) as being unpatentable over Rha (U.S. Patent No. 6,284,634) in view of Tanabe, et al. (U.S. Patent No. 6,323,115). In view of the amendments to the claims and the following remarks, the rejections are respectfully traversed, and reconsideration of the rejections is requested.

In the applicants' invention, a nitrogen containing gas is used during a selective oxidation process. The nitrogen combines with the metal in a metal gate electrode pattern to form metal nitride. As a result, the metal cannot react with oxygen in the process chamber, such that oxidation of the metal is minimized. The claims are amended and new claims are added to clarify that the selective oxidation process includes introduction of hydrogen, oxygen and/or vapor H₂O along with a nitrogen-containing gas. As set forth in the claims, during the selective oxidation process, the nitrogen-containing gas combines with the metal layer to form a metal nitride. It is believed that these amendments to the claims serve to clarify the distinctions between the applicants' invention and the cited Rha and Tanabe, et al. patents.

In Rha, a gate electrode includes a tungsten or tungsten silicide layer. Abnormal oxidation of the metal layer is inhibited by first annealing the structure in an environment that contains nitrogen. After the annealing is completed to form tungsten nitride 47 on the tungsten layer, the selective oxidation process is performed on the structure to relieve stress applied to the substrate. (See Rha at column 4 lines 8-9, column 4 lines 16-19, column 4 lines 22-24, and column 5 lines 21-29.) Clearly, Rha teaches a selective oxidation process performed separately from and after completion of an annealing step that creates tungsten nitride. That is, Rha does not teach or suggest the invention set forth in the applicants' claims in which creation of a metal

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nitride is performed simultaneously with a selective oxidation process.

In Tanabe, et al., nitrogen is contemplated only as an inert gas used to purge a process chamber before and after a light oxidation process (see Tanabe, et al. at column 18 lines 38-41, for example). As pointed out by the Examiner, Tanabe, et al. consider the possibility of a nitrification reaction at column 18, lines 33-38. However, Tanabe, et al. state that this nitrification reaction is not intended and is actually undesirable. Tanabe, et al. also state that under certain circumstances in which nitrification is to be avoided, it is preferred to completely discharge the nitrogen from the chamber. Accordingly, Tanabe, et al. do not teach or suggest introducing nitrogen into a selective oxidation process in order to form a metal nitride. In fact, on the contrary, Tanabe, et al. teach that "nitrification" is unintended and, in certain situations, is to be avoided such as by purging the nitrogen from the chamber. That is, Tanabe, et al. teach away from the applicants' claimed introduction of nitrogen to create a metal nitride.

Furthermore, Tanabe, et al. make a general reference to "nitrification." They do not make any suggestion as to what is being nitrified. This passing reference to nitrification in Tanabe, et al. cannot be construed as teaching or suggesting the applicants' claimed introduction of nitrogen-containing gas into a selective oxidation process for the explicit purpose of forming a metal nitride.

Accordingly, Tanabe, et al. also do not teach or suggest the invention set forth in the amended claims. That is, Tanabe, et al. do not teach or suggest simultaneously performing a selective oxidation process and forming a metal nitride on a metal layer.

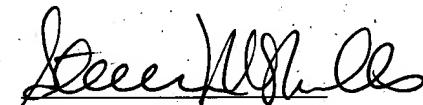
Since neither Rha nor Tanabe, et al. teach or suggest the invention set forth in the claims, there is no combination of the references that would result in providing such teaching or suggestion. That is, there is no combination of the references which would result in simultaneous performance of a selective oxidation process and creation of metal nitride on a metal layer. Since neither Rha nor Tanabe, et al., taken alone or in combination, teaches or

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suggests the invention set forth in the amended claims, it is believed that the claims are allowable over the cited references, and, therefore, reconsideration of the rejections of the claims under 35 U.S.C. §103(a) based on Rha and Tanabe, et al. is respectfully requested.

In view of the amendments to the claims and the foregoing remarks, it is believed that all claims pending in the application are in condition for allowance, and such allowance is respectfully solicited. If a telephone conference will expedite prosecution of the application, the Examiner is invited to telephone the undersigned.

Respectfully submitted,



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